FIG. 1

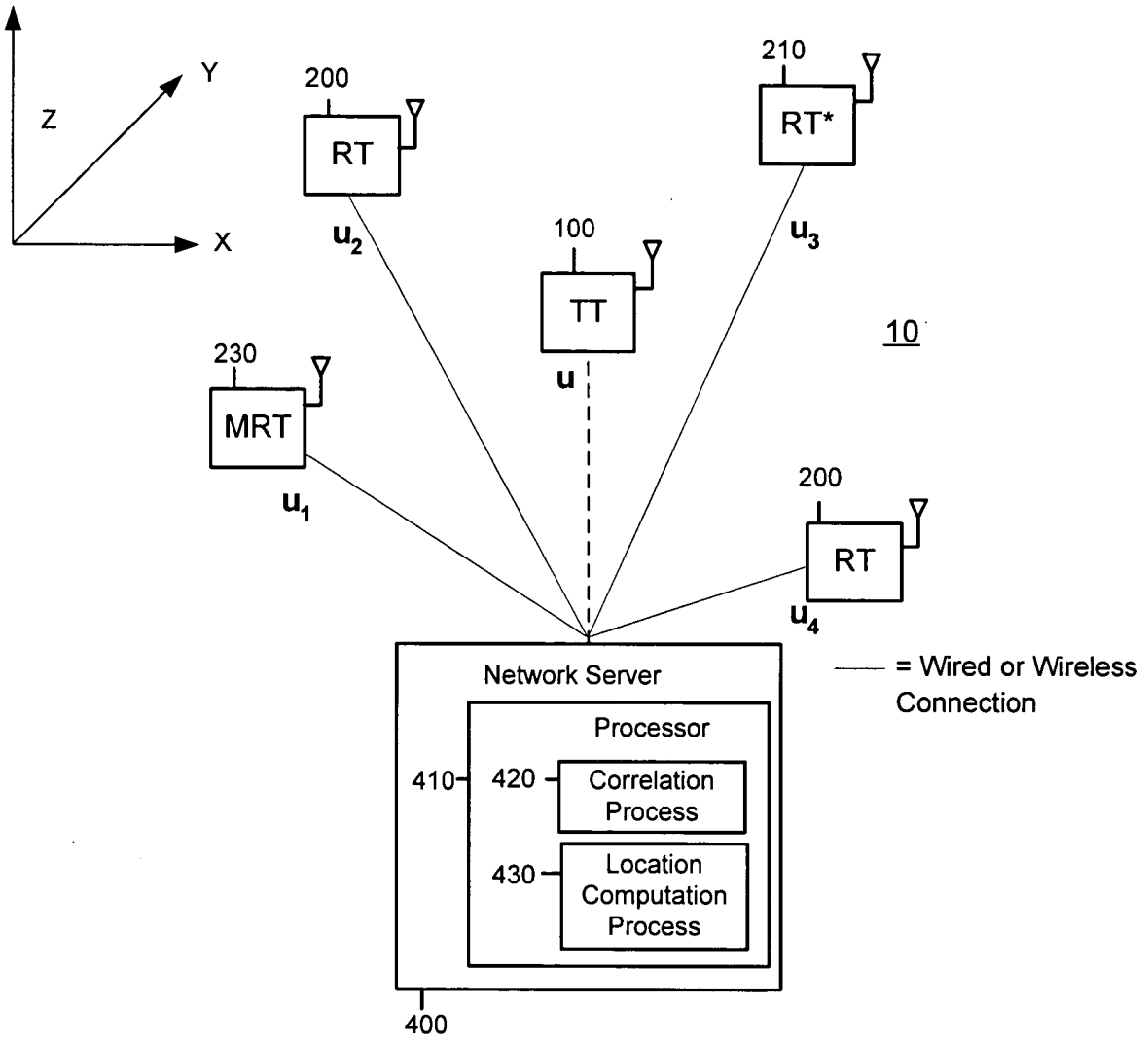

Y
Z
X
200
RT
u_2
210
RT*
u_3
100
TT
u
230
MRT
u_1
200
RT
u_4
10
Network Server
Processor
410
420
Correlation Process
430
Location Computation Process
400
= Wired or Wireless Connection

FIG. 2

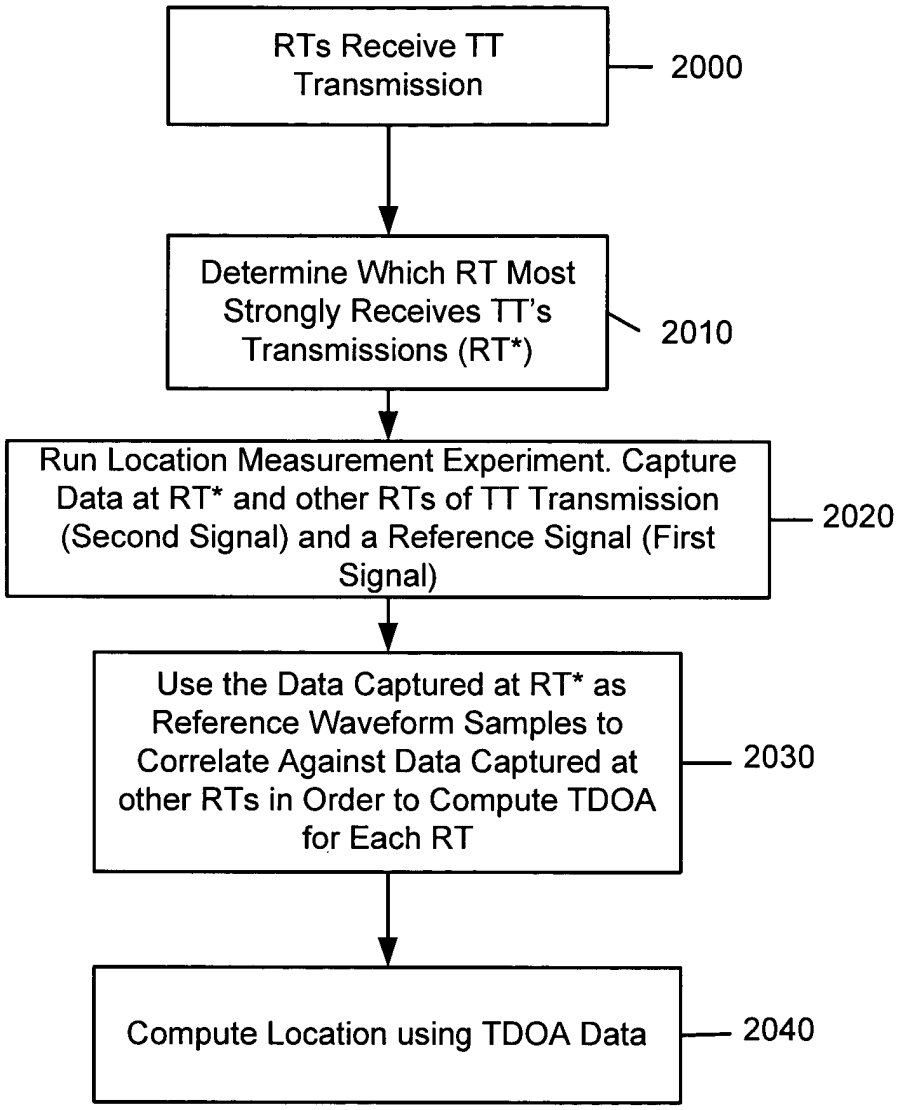

RTs Receive TT Transmission
2000
Determine Which RT Most Strongly Receives TT's Transmissions (RT*)
2010
Run Location Measurement Experiment. Capture Data at RT* and other RTs of TT Transmission (Second Signal) and a Reference Signal (First Signal)
2020
Use the Data Captured at RT* as Reference Waveform Samples to Correlate Against Data Captured at other RTs in Order to Compute TDOA for Each RT
2030
Compute Location using TDOA Data
2040

FIG. 3

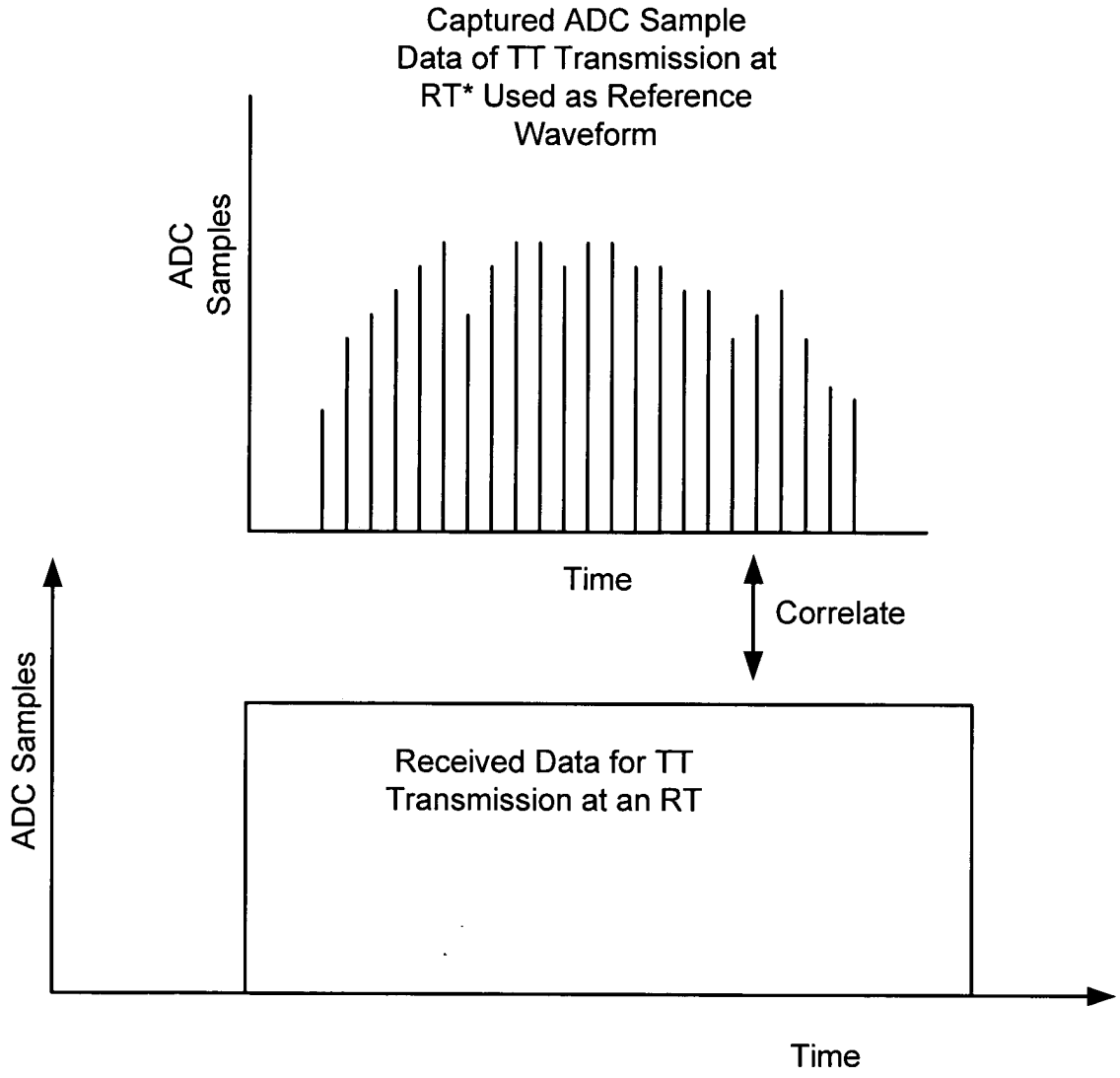

Captured ADC Sample Data of TT Transmission at RT* Used as Reference Waveform
ADC Samples
Time
Correlate
ADC Samples
Received Data for TT Transmission at an RT
Time

FIG. 4

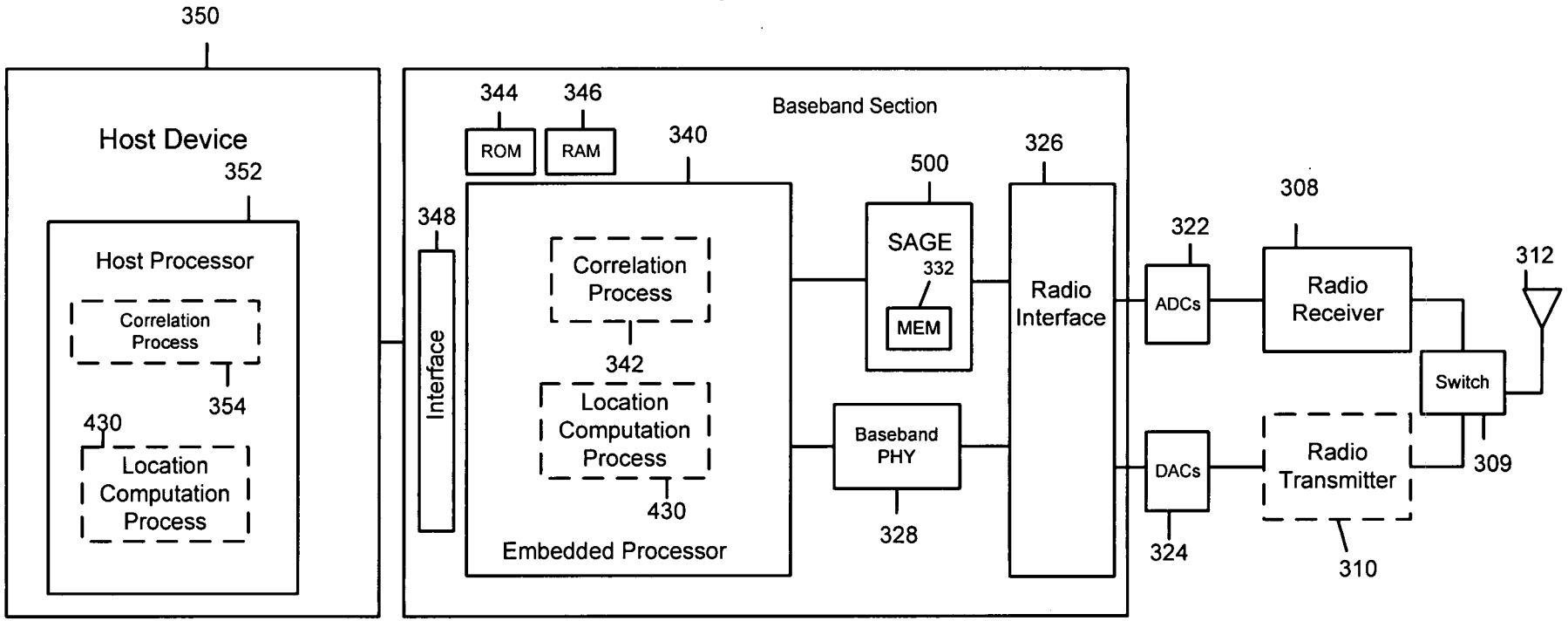

350
Host Device
352
Host Processor
Correlation Process
354
430
Location Computation Process
Interface
348
344
346
ROM
RAM
340
Baseband Section
Correlation Process
342
Location Computation Process
430
Embedded Processor
500
SAGE
332
MEM
Baseband PHY
328
326
Radio Interface
322
ADCs
DACs
324
308
Radio Receiver
Radio Transmitter
310
Switch
309
312

FIG. 5

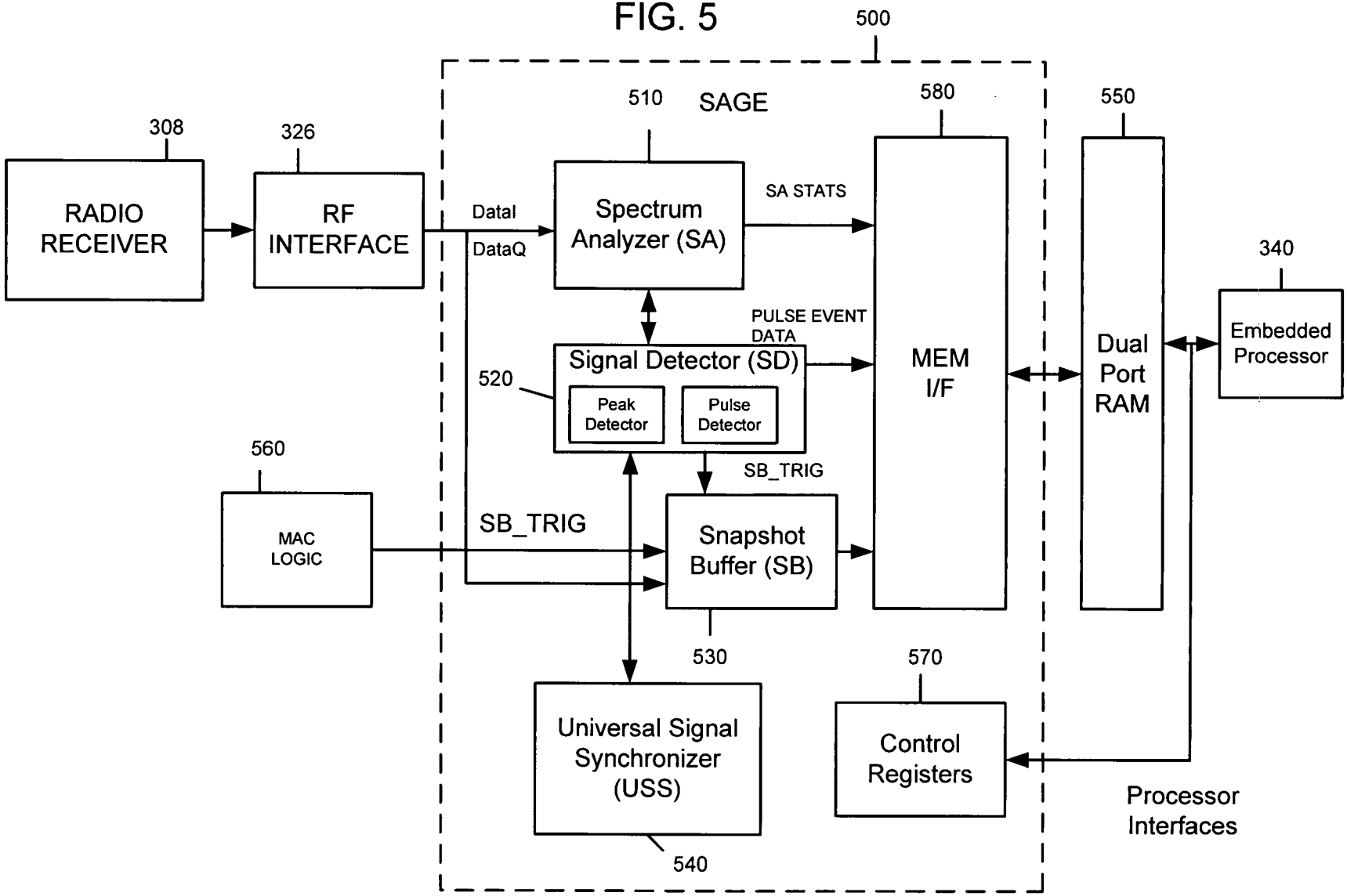

500
SAGE
510
580
550
308
326
340
RADIO RECEIVER
RF INTERFACE
Datal
DataQ
Spectrum Analyzer (SA)
SA STATS
PULSE EVENT DATA
Signal Detector (SD)
520
Peak Detector
Pulse Detector
MEM I/F
Dual Port RAM
Embedded Processor
560
MAC LOGIC
SB_TRIG
SB_TRIG
Snapshot Buffer (SB)
530
570
Universal Signal Synchronizer (USS)
Control Registers
Processor Interfaces
540

FIG. 6

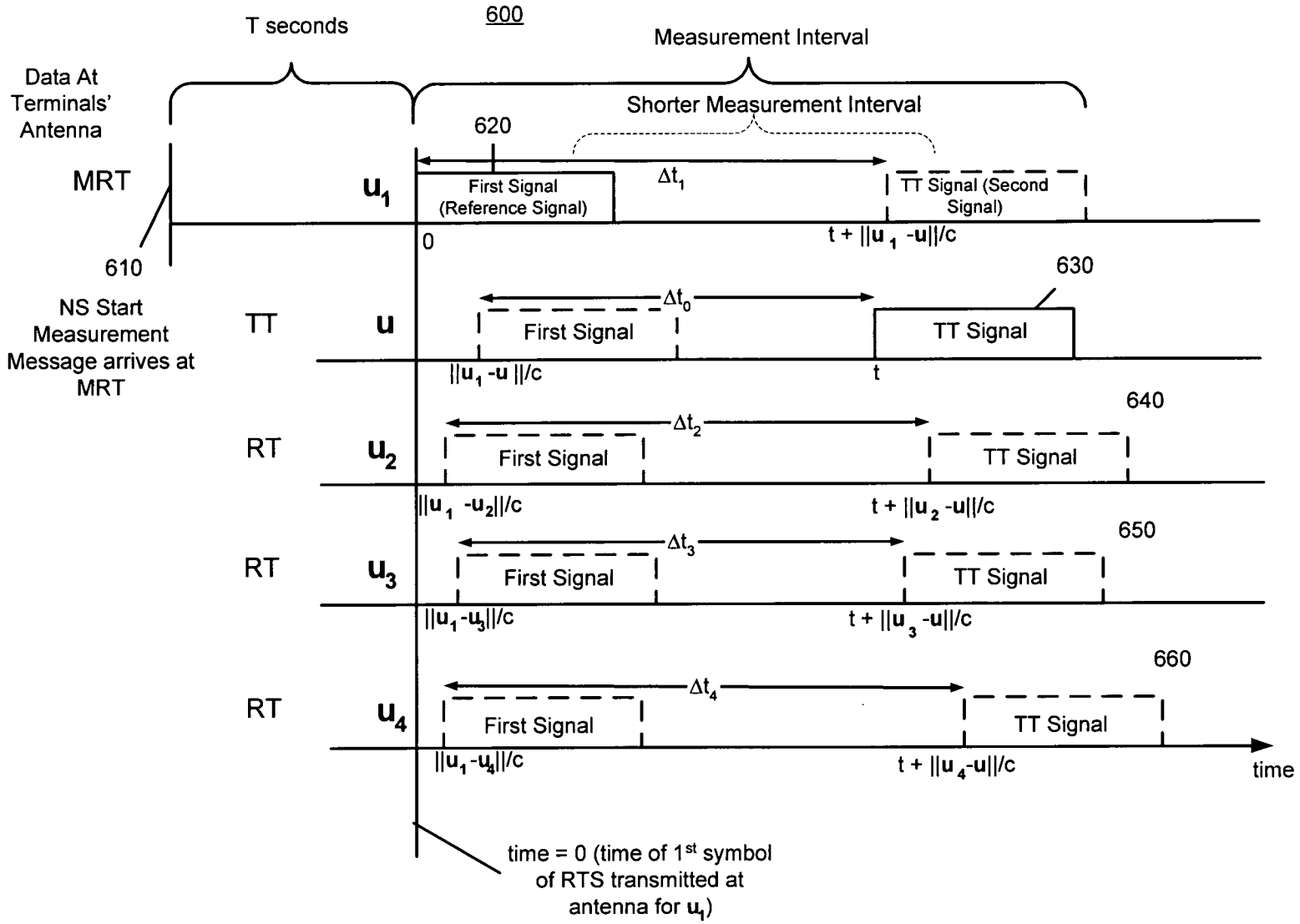

600
T seconds
Measurement Interval
Data At Terminals' Antenna
Shorter Measurement Interval
620
MRT
u_1
First Signal (Reference Signal)
Δt_1
TT Signal (Second Signal)
0
$t + ||u_1 - u||/c$
610
630
NS Start Measurement Message arrives at MRT
TT
u
Δt_0
First Signal
TT Signal
$||u_1 - u||/c$
t
640
RT
u_2
Δt_2
First Signal
TT Signal
$||u_1 - u_2||/c$
$t + ||u_2 - u||/c$
650
RT
u_3
Δt_3
First Signal
TT Signal
$||u_1 - u_3||/c$
$t + ||u_3 - u||/c$
660
RT
u_4
Δt_4
First Signal
TT Signal
$||u_1 - u_4||/c$
$t + ||u_4 - u||/c$
time
time = 0 (time of 1st symbol of RTS transmitted at antenna for u_1)

FIG. 7

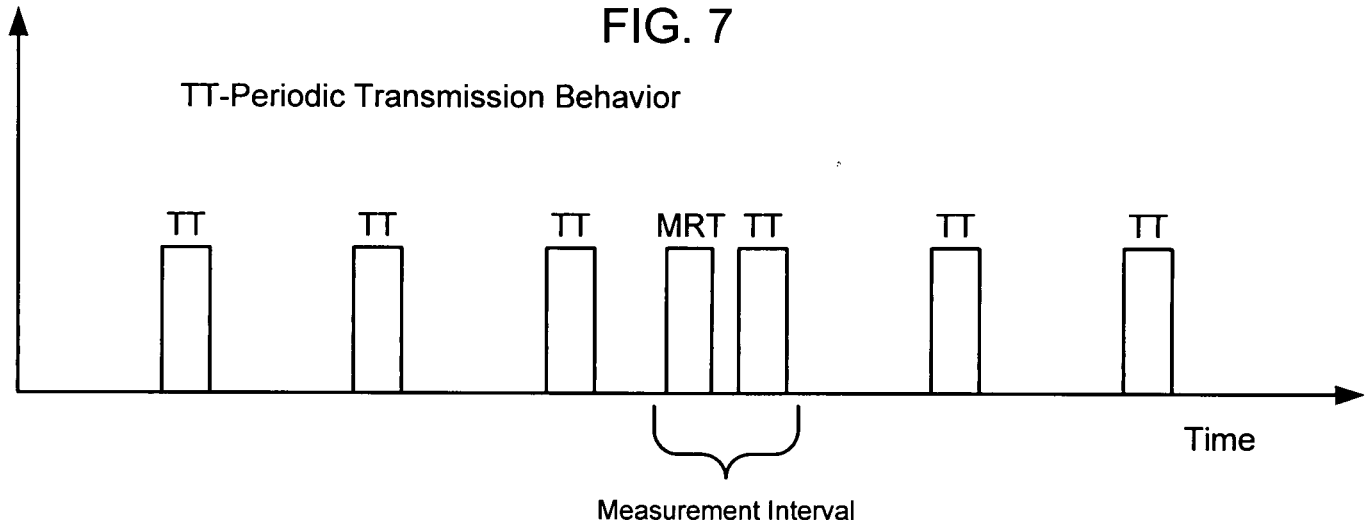

TT-Periodic Transmission Behavior
TT
TT
TT
MRT
TT
TT
TT
Time
Measurement Interval

FIG. 8

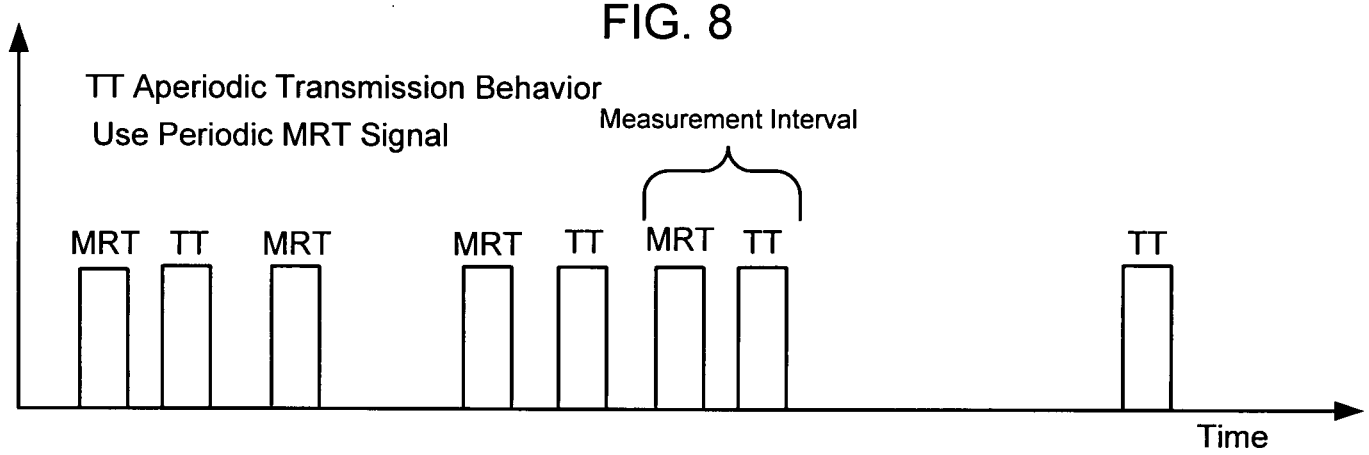

TT Aperiodic Transmission Behavior
Use Periodic MRT Signal
Measurement Interval
MRT
TT
MRT
MRT
TT
MRT
TT
TT
Time

FIG. 9

$$J(x,y,z,t)=\begin{bmatrix} \frac{\partial F_1}{\partial x} & \frac{\partial F_1}{\partial y} & \frac{\partial F_1}{\partial z} & c \\ \frac{\partial F_2}{\partial x} & \frac{\partial F_2}{\partial y} & \frac{\partial F_2}{\partial z} & c \\ \frac{\partial F_3}{\partial x} & \frac{\partial F_3}{\partial y} & \frac{\partial F_3}{\partial z} & c \\ \frac{\partial F_4}{\partial x} & \frac{\partial F_4}{\partial y} & \frac{\partial F_4}{\partial z} & c \end{bmatrix},$$

$$\frac{\partial F_i}{\partial x}=\frac{x-x_i}{\sqrt{(x-x_i)^2+(y-y_i)^2+(z-z_i)^2}},$$

$$\frac{\partial F_i}{\partial y}=\frac{y-y_i}{\sqrt{(x-x_i)^2+(y-y_i)^2+(z-z_i)^2}},$$

$$\frac{\partial F_i}{\partial z}=\frac{z-z_i}{\sqrt{(x-x_i)^2+(y-y_i)^2+(z-z_i)^2}}$$

FIG. 10

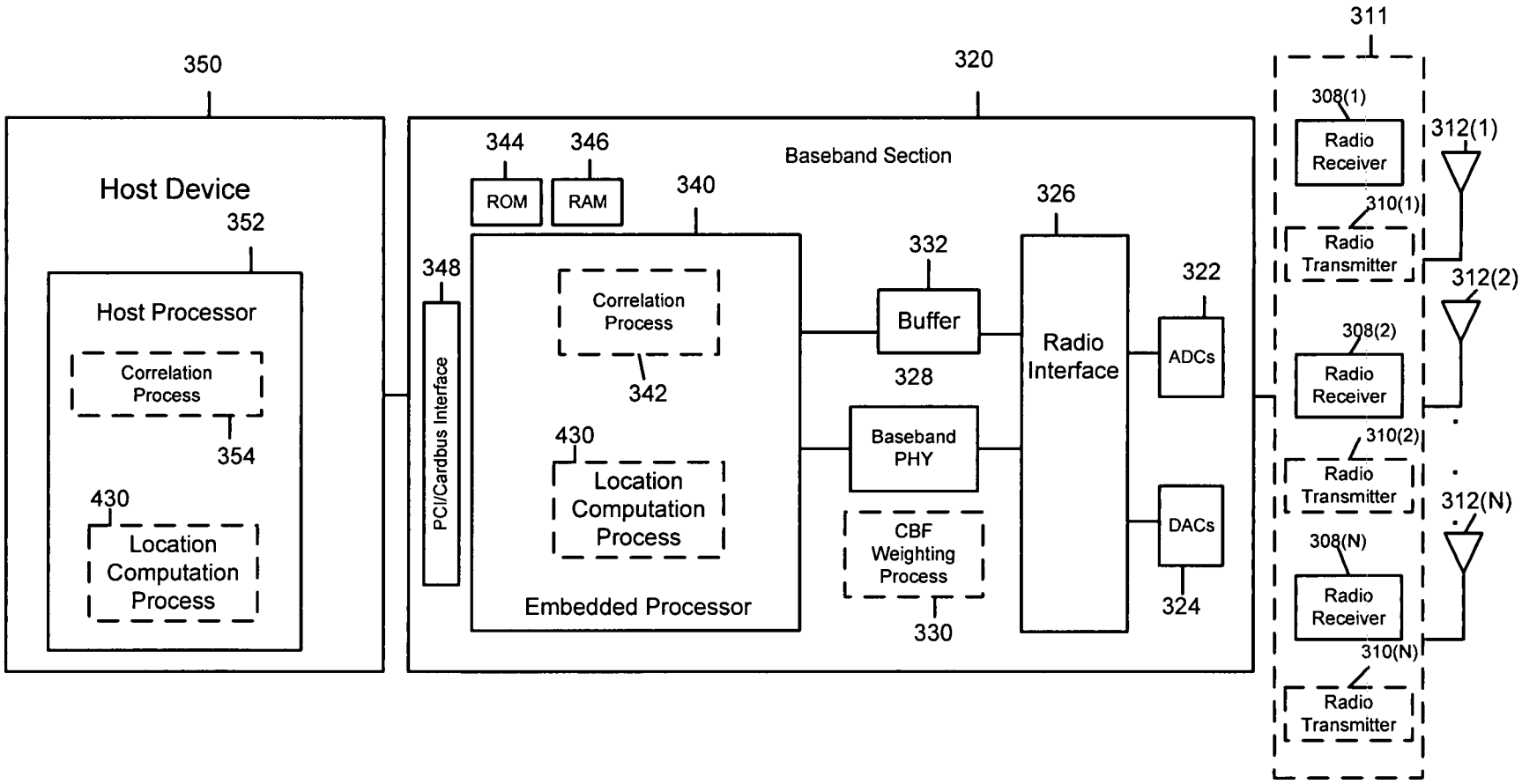

350
Host Device
352
Host Processor
Correlation Process
354
430
Location Computation Process
320
Baseband Section
344
346
ROM
RAM
340
348
PCI/Cardbus Interface
Correlation Process
342
430
Location Computation Process
Embedded Processor
332
Buffer
328
Baseband PHY
CBF Weighting Process
330
326
Radio Interface
322
ADCs
DACs
324
311
308(1)
Radio Receiver
310(1)
Radio Transmitter
312(1)
312(2)
308(2)
Radio Receiver
310(2)
Radio Transmitter
312(N)
308(N)
Radio Receiver
310(N)
Radio Transmitter

FIG. 11

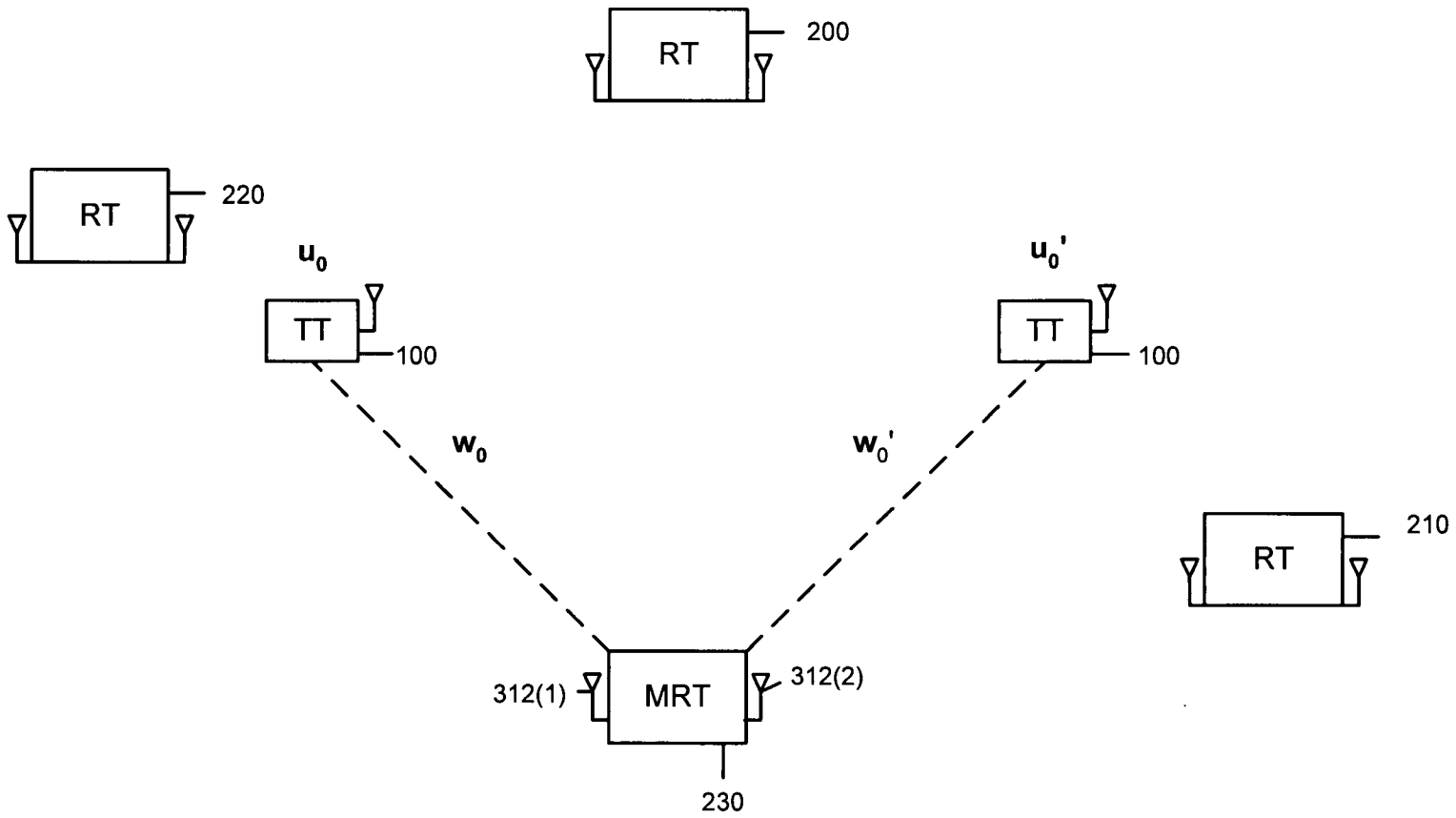


FIG. 12

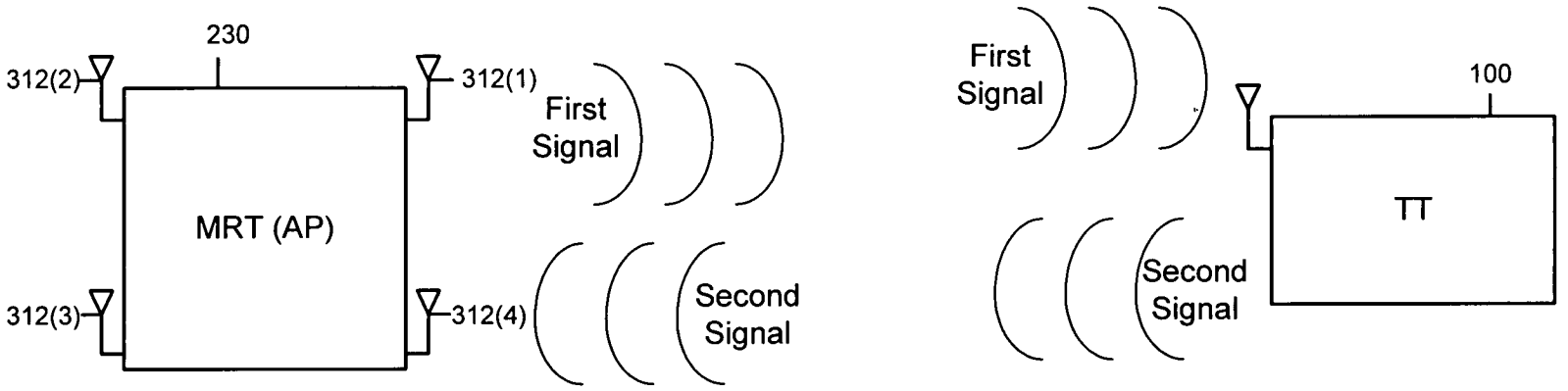

230
312(2)
312(1)
First
Signal
MRT (AP)
312(3)
312(4)
Second
Signal
First
Signal
100
TT
Second
Signal

FIG. 13

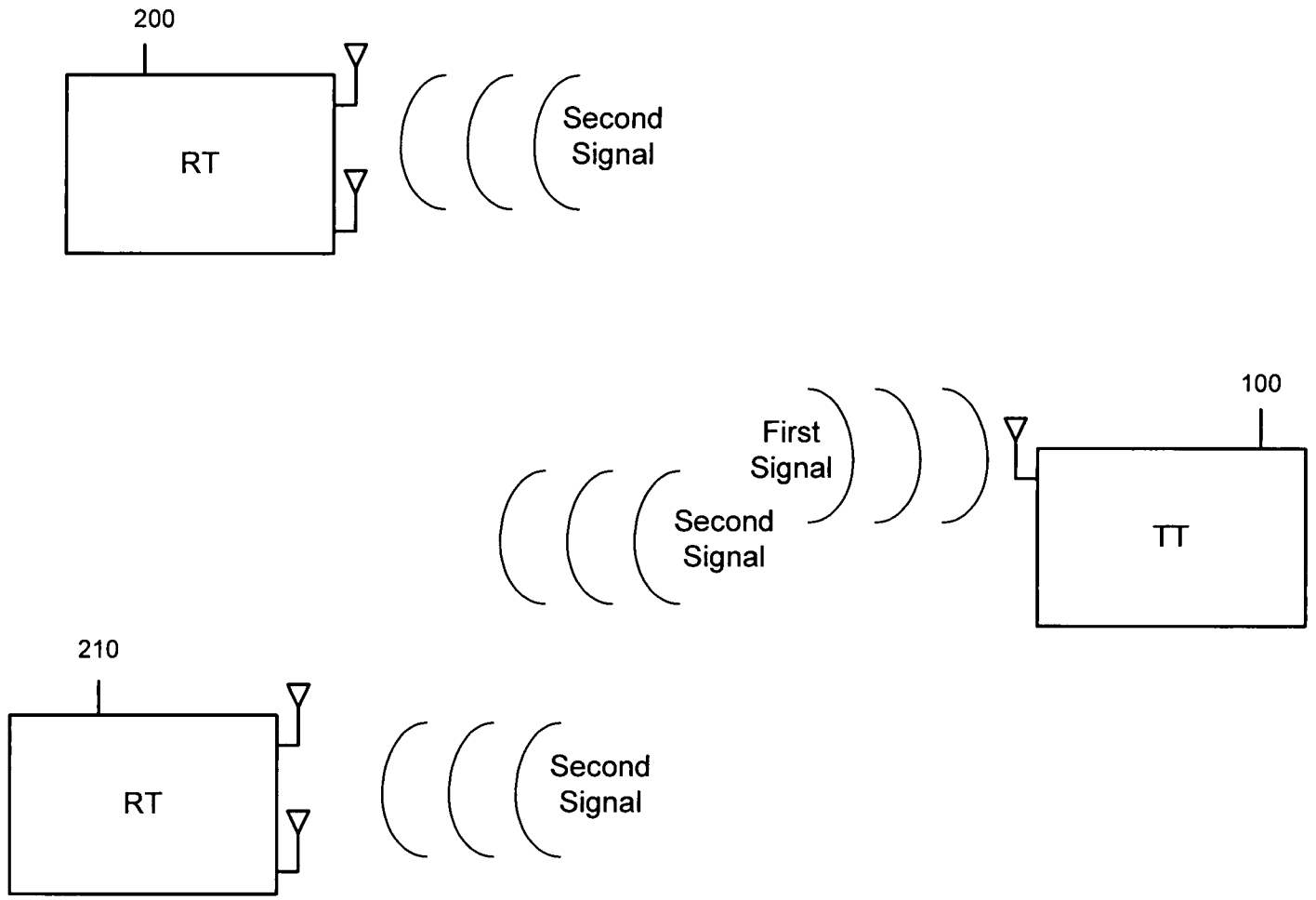
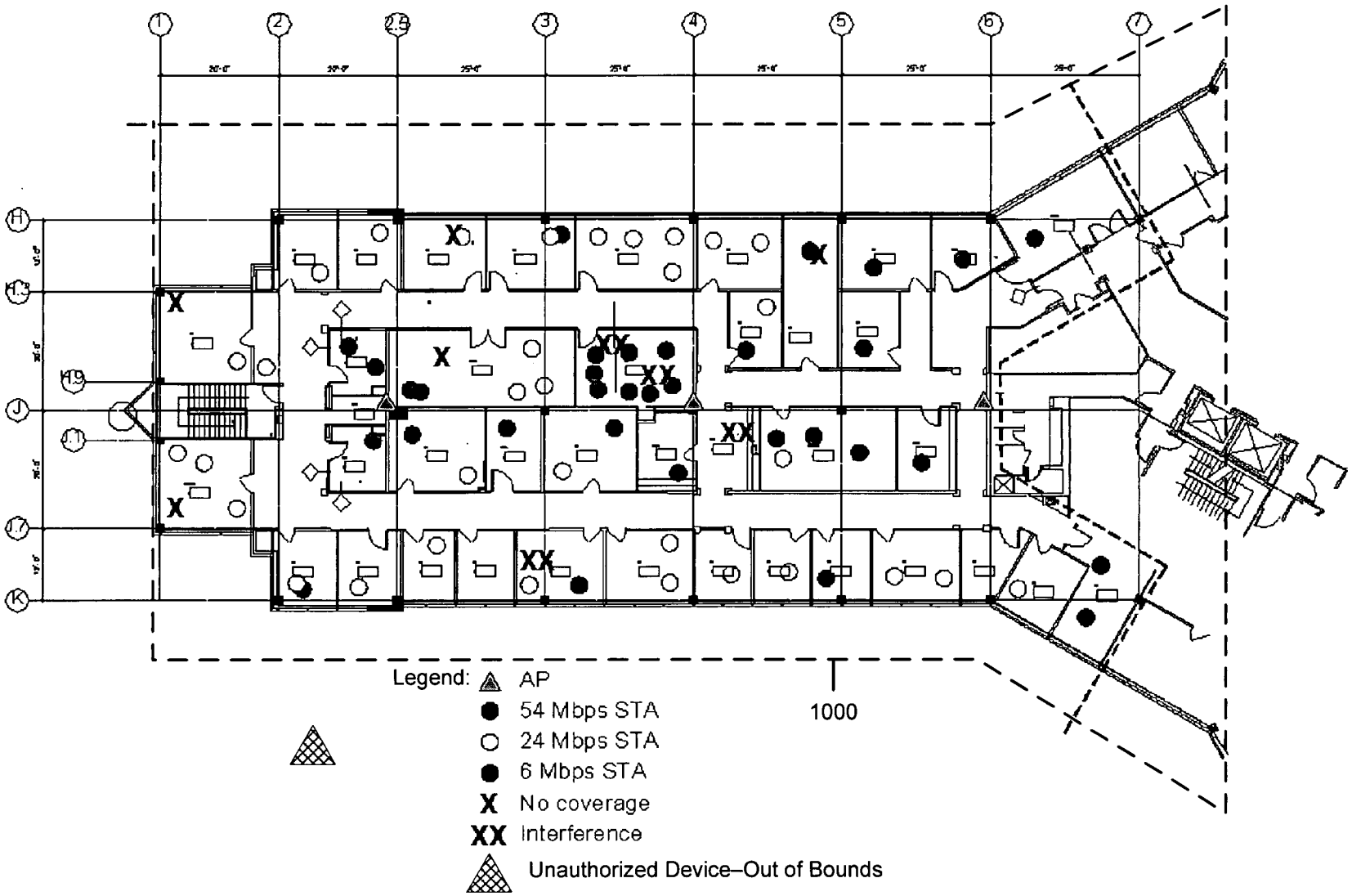

200
RT
Second
Signal
100
First
Signal
Second
Signal
TT
210
RT
Second
Signal

FIG. 14


Legend:
AP
54 Mbps STA
24 Mbps STA
6 Mbps STA
No coverage
Interference
Unauthorized Device–Out of Bounds
1000